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The Triple Helix Model for Fruits and Vegetables Supply Chain Management Development Involving Small Farmers in Order to Fulfill the Global Market Demand: a Case Study in "Value Chain Center (VCC) Universitas Padjadjaran"

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Abstract

Demand for fresh fruit and vegetable (FFV) is increasing as the rise of income per capita in some Asia Pacific countries, such as South Korea, Taiwan, and China, which are currently importing from South East Asia countries. Singapore is also the biggest importer country of FFV product, but only 6% of its market share can be taken by Indonesia. The major problem is the difficulty in meeting export quality standard of Indonesian agricultural product. To overcome this problem, institutional innovation is required so that supply chain management of FFV products can be improved. This paper discussed about the application of "triple helix model" on interaction between universities, exporters, government, and supporting institutions in developing FFV supply chain management. This study was using case study method on triple helix model developed by Value Chain Center of Universitas Padjadjaran. Causal Loop Diagram as a part of system thinking approach was used as the analysis tool. Results indicated that multi-stakeholders interaction opens the opportunity for FFV farmers to get involved in supply chain of export market. Institutional innovation has a role as a risk reducer that provides supporting services to the farmers in order to meet export market demand.

Keywords: Institutional Innovation; triple helix model; supply chain management

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1. Background

Within the last five years, Asia Pacific regions showed a significant growth in economy (around 7%) especially for China and India. This surely encourages per capita incomes which in the end affecting the demands for fresh fruit and vegetables consumption. Taiwan, South Korea and China are the countries in East Asia which give the most contribution (around 31.5%) to Asia Pacific region's output. Taiwan and South Korea get their fresh fruits and vegetables supply from South East Asia countries, including Indonesia. China is one of horticulture exporters for Europe and the United States, yet in order to fulfill the needs of its own consumption China importing fresh fruits and vegetables from the South East Asian regions (Kanlayanarat *et al*, 2009).

Aside from those three East Asian countries, Singapore, a small country in South East Asia has a high demand for fresh fruits and vegetables (350.000 tons per year). This demand will keep growing in line with their high economy growth rate. In 2009, most of Singapore fresh fruits and vegetables supply came from China and Malaysia, as for Indonesia gets only 6% of the Singapore market share. AVA, the food agency of Singapore is currently probing for the possibilities to develop Indonesian supply of fresh fruits and vegetables in order to lessen its dependence to China as the current supplier leader for fruits and vegetables (Perdana, 2009). Since the end of 2009, Indonesian government responded to Singapore's eagerness by encouraging the fruits and vegetables export acceleration program.

To enhance the competitiveness of Indonesian fruits and vegetables commodities in the global market, a comprehensive development of supply chain management is required. A supply chain management which is able to create and distribute the value added to all involved actors in this agribusiness. Supply chain management is an integration of main business process from end user through the distributors which distribute the services and information which has a value added for the consumers and other stakeholders (Mentzer *et al*., 2001).

Value added creation is an effort to embody the business efficiency, while value added distribution is a process to create the business equity (Bunte, 2006). Efficiency and equity are the requirement to actualize the competitiveness, due to the characteristic of Indonesian fruits and vegetables farmers which are mostly have a small scale business and scattered in different production areas. Small farmers involvement is one of the keywords aside the competitiveness and equity in supply chain development for agribusiness and agro-industry in developing countries (Chowdury *et al*. 2005; Vorley and Proctor, 2008; Da Silva and Baker, 2009).

Small farmers in developing countries generally have some bounds in accessing the technologies, extension services, and market integration (Devaux *et al*.,2009 ; Ferroni and Castle, 2011). This condition also happened to fruits and vegetables small farmers in Indonesia, thus they are not able to meet the export standard requirements such as continuity of quantity, quality, food safety and competitive prices.

Institutional innovation is crucial in developing the supply chain management for fruits and vegetables commodities which involve the farmers in order to meet the global market demand. The institutional innovation has to be a set of rules which is able to reduce the risk and transaction cost which will mostly generated due to small farmers restrictions. This institutional innovation will be emerged by the interaction between small farmers and the market, universities, private parties, and government (Perdana *et al*., 2011). The interaction between universities, private parties or industries, and government is the key to innovation and development in this era of science based economy (Etzkowitz, 2008).

This article will discuss a case study of "triple helix model" applied in interaction between university, exporter, government, and supporting institution in developing fruits and vegetables supply chain management which involves the small farmers to meet the global market demand. The model will generate an institutional innovation which is able to reduce the risk and transaction cost. Besides, this model will also shows the efforts to handle the hindrances which faced by the small farmers in accessing the technology, extension services, and market.

2. Methodology

This study uses a case study method which aims to comprehensively discuss the role of Triple Helix Model which has been developed by the Value Chain Center (VCC) in the development of fruits and vegetables supply chain management which involves the small farmers to fulfil the global market demands. The discussion in this article uses the Causal Loop Diagram (CLD) as a part of system thinking approach (Maani and Cavana, 2007). System thinking is a part of System Dynamics, an approach which uses the information feed back perspective and delays to determine the complexity of dynamics behaviors of biology, physics, and social system (Sterman 2000). CLD shows a complex interaction in form of feedbacks from many variables in the model.

3. The Role of Value Chain Center of Universitas Padjadjaran in Developing The Triple Helix Model for Fruits and Vegetables for Export Market Supply Chain

Universitas Padjadjaran is one of universities which located nearby the production area for fruits and vegetables commodities in West Java. It will take around 30 minutes from Padjadjaran University to go to Lembang which is one of fruits and vegetables production areas in West Java. The Value Chain Center is a part of Universitas Padjadjaran which is established by its collaboration with AMARTA (Agribusiness Market Support Activity) USAID in the midst of 2009. VCC was established to meet the requirements of West Java agribusiness development stakeholders (farmers, exporters, supermarkets, banks, governments, associations, and NGOs), it's a presence of an institution with the ability to bridge the farmers needs with the markets and governments in order to raise the competitiveness of West Java agribusiness.

VCC has three main activities: (1) arranging a multi-stakeholders meeting to handle the hindrances faced by the small farmers in accessing the technology, market information, and financing; (2) conducting several trainings for the agribusiness actors from small farmers to processors and marketers, government from central to local governments; and (3) conducting researches such as policy analysis and simulation for the policy makers. Those activities were conducted based on the needs of stakeholders.

In the end of 2009, VCC and Indonesian Fruits and Vegetables Exporters Association (AESBI) were involved in fruits and vegetables export from Indonesia to Singapore acceleration program collaborating with Indonesian Ministry of Agriculture. VCC is one of taskforce members for fruits and vegetables export along with the exporters, farmers associations, The Ministry of Agriculture, Agricultural Service, and AVA (Agri-food and Veterinary Authority) Singapore.

As follow up to the export taskforce activity, in early 2010 a deal between Rector of Universitas Padjadjaran with the Director of PT. Alamanda Sejati Utama as horticulture exporters, to develop the fruits and vegetables to meet the demand of export market. This agreement was also being witnessed by the Director of Vegetables Crop, Ministry of Agriculture, Head of Food Crops and Agricultural Services in West Java, and representation of AMARTA USAID. In that agreement, VCC was being pointed as implementer.

For the implementation of those programs, VCC applied the fruits and vegetable supply chain model which has been developed by the VCC using System Dynamics approach. This model is an integration between the six supply chain management components which are: supply chain restructurization, quality engineering, hybrid production system, institutional innovation, balanced performance measurement system, and consolidators (Figure 1).

Those components interacted systematically to reach the efficient, responsive, inclusive, and equal supply chain. Thus, if one of the components is not in place or not working properly, then it will not able to reach the goal.

The supply chain restructurization has to be able to send the material flow, financial flow, and information flow precisely in terms of quantity, quality, time, price, transparency, food safety, and continuity to ensure the consumers satisfaction and protection. VCC Universitas Padjadjaran has conducted the restructurization for fruits and vegetables supply chain by providing the access for the small farmers to the exporter PT. Alamanda Sejati

Utama. By strengthening the farmers group, the small farmers were being encouraged to apply the collective system in their business. The farmers group has a role to act as the farmers' representation in their interaction with the market. This collective system replaced the role of the local collectors, but in the collective system there is no transaction between the small farmers with their groups.

The quality engineering has to be able to create a value added which are fit to the dynamics of market demand. Quality management system is being applied by doing harvest sortation, post-harvest sortation and grading, cold chain system application, Good Agriculture Practices (GAP) and Good Handling Practices (GHP) Application. These activities are being done by the farmers group as part of their service to the members.

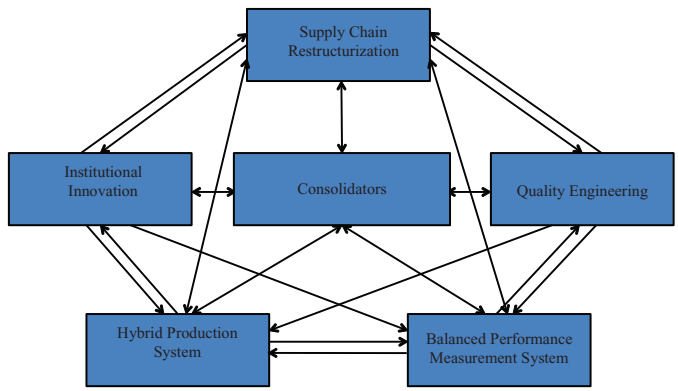

Fig. 1. Model of Fruits and Vegetables Supply Chain Management Involving the Small Farmers

The hybrid production system is the application of the decoupling point between demand and production in a supply chain which synchronize the production and the market demand. In the implementation, the farmers groups were being supported to be a customer order decoupling point which has the decision management based on consumer demand (pull system) and the production plan were being made based on the forecasting of their partner (exporter). Hybrid production system aims to respon the market dynamics in terms of quantity, quality, and continuity (Goncalves *et al* ,2004; Perdana *et al,* 2011;). The decoupling point between supply and demand aims to reduce the excess supply in the supply chain and to improve the market penetration and the logistic system (Van der Vorst *et al,* 2007). The application of decoupling point in supply and demand is the characteristic of demand driven chain network which combines the efficient aspect in fulfilling the market demand and flexibility aspect in facing the market dynamics (Verdouw *et al,* 2006).

Along with the creation of efficient system, the institutional innovation components will create a balanced value added distribution. The developed institutional innovation has to be able to solve the problems which will occur due to the small farmers hindrances. Institutional innovation is a set of rules for a community or organization which facilitates the coordination between the involved social actors to reach their goal (Ruttan, 2006). With this rule, each actor has its own motivation to be involved in a community or organization. In terms of economic relationship, institution has a very important role in determining the usage of resources in the economic activities and distributing the profit generated by those activities. Furthermore, Shirley dan Meenard (2008) stated that an institution has to be able to reduce the risks and transactional costs which occurred due to the hindrances of the involved actors.

In order to identify the distribution of value added and the most efficient system, a performance measurement system is needed. This measurement system includes financial perspective, consumer perspective, internal business process perspective, learning and development perspective, and value added perspective.

Consolidators are those who bridge the gap between the actors inside and outside the production area. These actors are being guided by the consolidators in terms of production technology, management, and institutional

strengthening in order to fulfill the market demand. Besides, the consolidators are also actively involved in improving the access of the producers and other actors to the agro-inputs, technology, market, and finance.

In this model, VCC acted as supply chain consolidator which gives services to the exporters and small farmers especially in technical, managerial, institutional, access to technology, financing, and market. The agreement scopes vegetables commodities, which are: green bean, paprika, leaf vegetables, zucchini, radish, corn, onions, and chili, and also fruits commodities such as pink guava and mango. The targeted areas are Pangalengan and Ciwidey for Bandung Regency area, Cisarua and Lembang for West Bandung Regency area, Panyingkiran and Maja for Majalengka Regency Area, and Jonggol in Bogor Regency.

In this agreement, the Ministry of Agriculture and Food Crops and Agricultural Services of West Java supported the activities by giving the supporting facilities such as packing house with cold chain system to partnered farmers groups. Up to this time, four packing houses have been built for vegetables commodities such as green bean, leaf vegetables, and paprika in the central production area of Bandung. AMARTA USAID was also supporting the activities by funding the trainings and building some demonstration plots.

VCC puts its staffs in several partnered farmers groups. They are the consolidators assigned to guide the farmers in meeting the exporters demand. VCC staffs along with the farmers and exporters made the production plan based on the agreement on export market demand. Those staffs get their salary from the fee generated on each fruits and vegetables volume distributed to the exporters and met the Singapore import standard.

In VCC-Exporter-government interaction, there were several problems which affected to the performance of the fruits and vegetables supply from the small farmers. The problems were unorganized farmers groups, delayed payment from the exporters, rejected goods, the field staffs inability to handle the groups dynamics, and the unpredictable climate change. All those problems generated risks for the small farmers, exporters, and VCC itself.

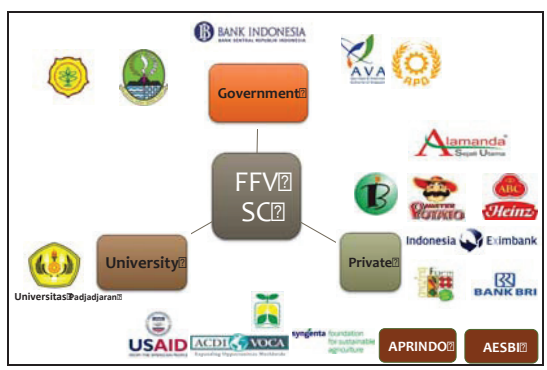

Fig. 2. The Triple Helix Model of Fruits and Vegetables Supply Chain Development of VCC Universitas Padjadjaran

Based on program evaluation, there are two type of risk which were faced by all involved parties in the interaction. The first was the risk which can be handled this model such as unorganized farmers groups, rejected goods, and field staffs' flaw. The second was the risk which cannot be handled by the interaction model such as cancelled order, delayed payment, and climate change.

To handle the second type risks, VCC worked with other parties such as banks (Bank of Indonesia, Agro Bank, and BMPD), Syngenta Foundation, other market stakeholders (supermarkets and agro-industry) and encouraging the role of local government (Figure 2). With this multi-stakeholders interaction, those risks were able to be reduced, and the performance of fruits and vegetables supply from the small farmers was increased.

4. Understanding the Triple Helix Model by using the System Thinking Approach

This section will discuss the role of "Triple Helix Model" which was developed by the VCC Universitas Padjadjaran in developing the exported fruits and vegetables supply chain management which involves the small farmers by using the system thinking approach. Causal Loop Diagram (CLD) was used as a tool to understand the complexity of interactions occurred in many variables of the role of "triple helix model".

As an institutional innovation in the agricultural cluster level, the Triple helix model has a role as the risk reducer by giving the services in improving the small farmers' capacity so that they are able to access the high quality agro-inputs, technologies, financing and market. Figure 3 below showed a complex interaction occurred in the Triple helix model.

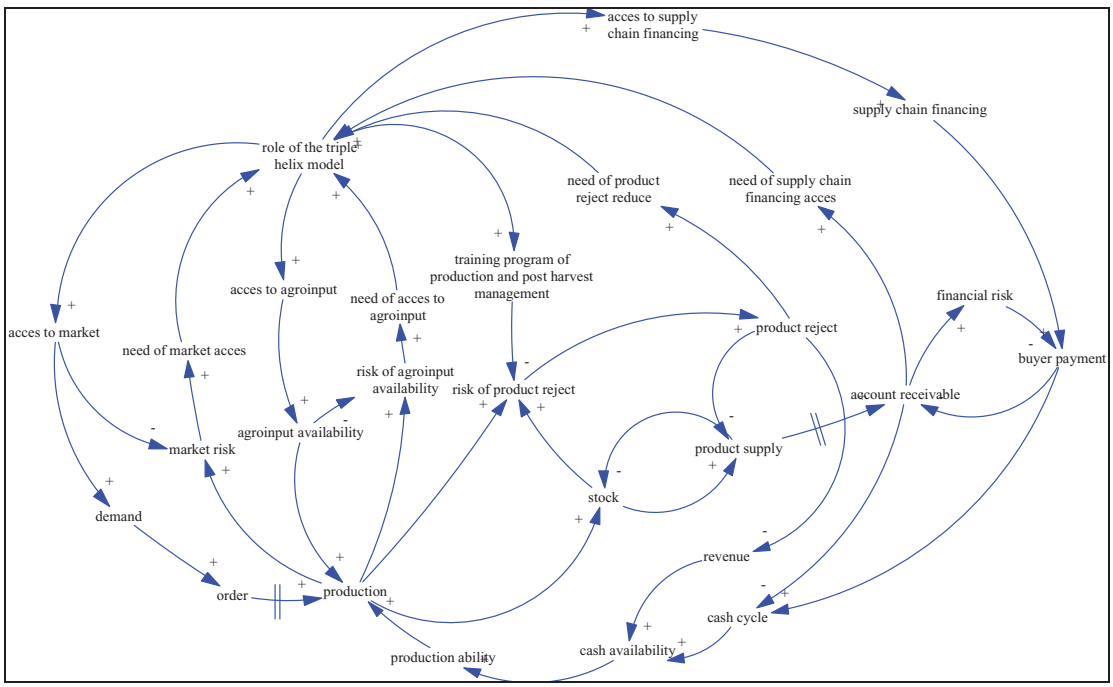

Fig. 3. CLD the role of triple helix model in developing the exported fruits and vegetables supply chain which involves the small farmers

In the system thinking, the discussion of triple helix model roles can be started from anywhere. However, this article will start it from the market access. This is because the VCC started to develop the fruits and vegetables supply chain management by establishing the market by linking the exporters along with other stakeholders with the small farmers.

Inclusively, Figure 4 shows the role of Triple helix model as the facilitator in improving the small farmers' market access to the export market. In general, the Indonesian small farmers sold their products to the traditional market (wet market) through the local collectors. Besides, they don't have the capacity to directly access the export market. Thus, along with the increase of their production level, they will more likely to face the higher level of market risks. The market risk is mostly in a form of price volatility due to the behaviour of traditional market chain. The higher the market risk caused the needs to access a more structured market (export, agro-industry, supermarket and food services) increased. The needs of an access to a more structured market has emerged the triple helix model to provide the small farmers with an access to a more structured markets. The market access which keeps improving by being facilitated by the triple helix model will reduce the market risk of the small farmers. The interaction between many variables will produce a negative feedback which means that

each market access which is facilitated by the triple helix model is on its path to the equity to reduce the market risks faced by the small farmers.

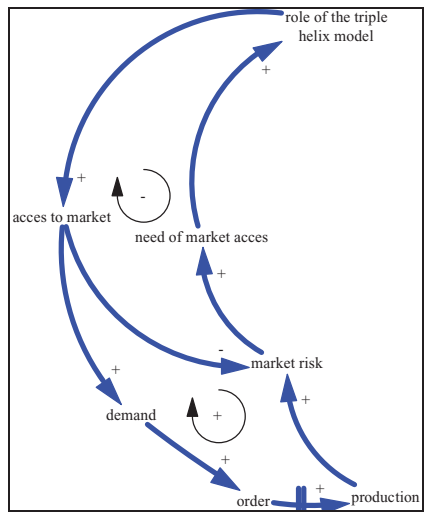

Fig. 4. CLD the role of triple helix model in market access improvement

Aside of that, the increasing market access also caused an increase of demands of the small farmers products, so that it can be a foot hold for certain period to increase their production capacity. The interaction between many variables such as production, market risk, market access needs, the role of triple helix model, market access, and demands will generate a positive feed back which means that the improvement of market access which is facilitated by the triple helix model will generate the growing behaviour or strengthening of demands for the small farmers.

Along with the improvement in the production capacity, the risk of buyers rejected product will also increasing. Thus, a program which can reduce the risk is needed. As the needs of this program gets higher, then the role of triple helix model will also increasing in the form of production and post harvest management system training program. This training will provide varies of technologies to reduce the risk of the product getting rejected by the buyers. The interaction of many related variables will generate a negative feed back which means that each training program will be on the path to the balance in order to reduce this risk (Figure 5).

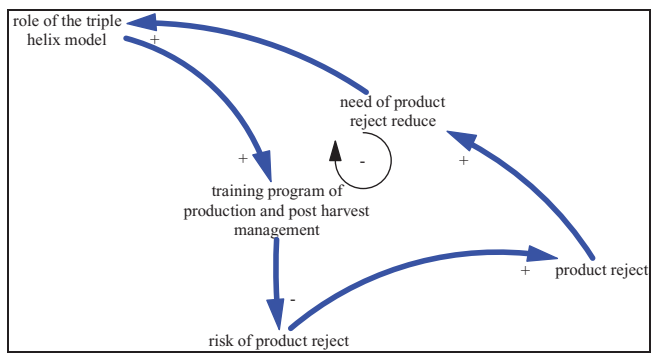

Fig. 5. CLD the role of triple helix model in reducing the risk of rejected product

Figure 6 shows the role of triple helix model in providing the high quality agro-input access to the farmers. As the production capacity of the small farmers increases, the risk of the availability of the high quality agro-inputs will also increase. This will also increase the needs of the access to the high quality agro-inputs. Thus, the role of triple helix model in providing the access to high quality agro-inputs will also increase.

The increase of small farmers access to high quality agro-input will cause the supply of agro-inputs increases so that it will be able to increase the production and reduce the risk. The interaction of many variables with this risk will generate a negative feed back which means the role of triple helix model in improving the access to high quality agro-inputs will be on a balancing path to reduce the risk.

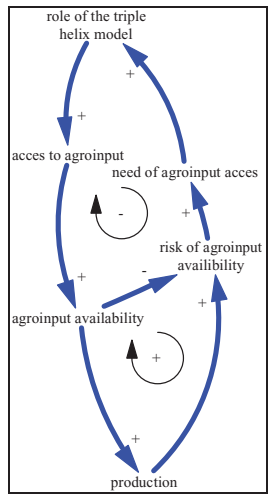

Fig. 6. CLD The role of triple helix model in improving the access to the high quality agro-inputs

The increase in the production capacity will also increase the stock of supply of small farmers. Small farmers stored their products for short period of time (less than 3 days), because of the limited durability of the products. Increased stored product will increase the supply to the exporters. The exporters applied a long time of payment, around 14-21 days. This means that in certain period of time it will increase the amount of debt of small farmers. This will cause an increase in the needs of supply chain financing access. Thus, the role of triple helix model to provide the access to finance will also be increased.

The service to provide the access to finance which is provided by the triple helix model will increase the access to supply chain financing. The presence of supply chain financing in form of bridging finance will reduce the time of payment applied by the buyers so that the cash flow of the small farmers will also increases. This will increase the farmers' cash availability to be increased so that the farmers will be able to improve their fruits and vegetables production (Figure 7). The interaction of many related variables will generate a positive feedback which means the financing access improvement will increase the small farmers production capacity.

Aside of that, the interaction between related variable in the service to provide the access to finance with the amount of small farmers debts will generate a negative feedback. This means that the access to finance improvement in the supply chain will be on the path of balance to reduce the amount of small farmers' debt.

According to above discussion, it is clear that the triple helix model in the development of small farmers exported fruits and vegetables supply chain management has a high complexity. Thus, this model will not be able to be understood by a linear and reductionist way of thinking, but with the system thinking approach. Thus, the triple helix model which is developed and managed by the VCC of Universitas Padjadjaran has a strong link and interaction between the government, academics, and industry. Etzkowitz (2008) stated this as a "social structure triple helix" because this "triple helix model" contains a "sharing knowledge and experience" between many involved actors, which being conducted in the campus in the form of lecture or seminar, and also outside campus

in the form of consultation, seminar, and multi-stakeholders meeting. Besides, all outputs of "sharing knowledge and experience" activity are being synthesized in the form of policy brief which is then delivered to the policy maker (government).

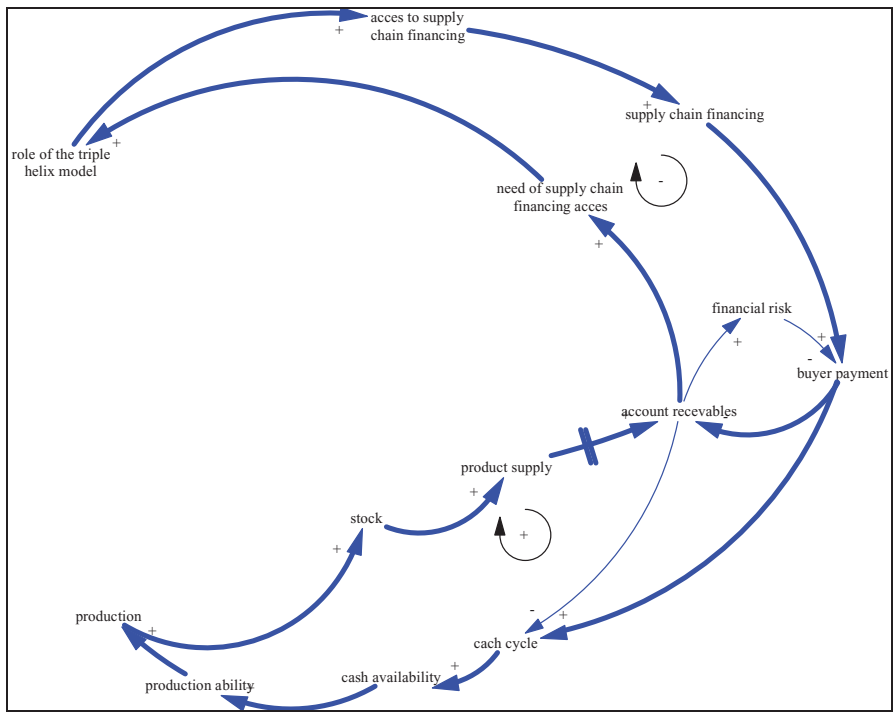

Fig. 7. CLD the role of triple helix model in providing the access to supply chain financing

5. Conclusion and Policy Implication

The multi-stakeholders interaction in the triple helix model is able to involve the small farmers in the exported fruits and vegetables supply chain and able to create an institutional innovation in the form of set of relationship rules in the production level, supply chain level, and agriculture cluster level which are able to reduce the risks which occur in its development. The realized policy implication of this interaction is the replication of this model in other areas which are being conducted by the government.

6. Directions for Further Study

The further study that can be developed is to develop a system of information to measure the performance of this multi-stakeholder interaction in the supply chain, and the development of policy simulator as a matter to improve the triple helix model policy in Indonesia.

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